State Water Resources Control Board

TO: Gerald Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board

FROM: Kari Kyler
Environmental Scientist, Bay-Delta Unit KK
DIVISION OF WATER RIGHTS

DATE: August 12, 2011

SUBJECT: REQUEST FOR SCIENTIFIC PEER REVIEW OF THE TECHNICAL REPORT ON THE SCIENTIFIC BASIS FOR: 1) ALTERNATIVE SAN JOAQUIN RIVER FLOW OBJECTIVES FOR THE PROTECTION OF FISH AND WILDLIFE BENEFICIAL USES AND PROGRAM OF IMPLEMENTATION; AND 2) ALTERNATIVE WATER QUALITY OBJECTIVES FOR THE PROTECTION OF SOUTHERN DELTA AGRICULTURAL BENEFICIAL USES AND PROGRAM OF IMPLEMENTATION

In accordance with Health and Safety Code section 57004, the State Water Resources Control Board (State Water Board), Division of Water Rights (Division), submits this request for identification of at least three peer reviewers to conduct a peer review of the State Water Board's report titled "Technical Report on the Scientific Basis for Alternative San Joaquin River Flow Objectives for the Protection of Fish and Wildlife Beneficial Uses and Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses and the Program of Implementation for Those Objectives" (Technical Report). The Technical Report includes proposed draft changes to the San Joaquin River flow and southern Delta water quality objectives and the Program of Implementation for those objectives. The Technical Report also discusses the scientific basis and tools used for developing and evaluating the impacts of potential changes to the objectives and the program of implementation for those objectives in the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (2006 Bay-Delta Plan).

The Division's current schedule for this project calls for beginning the peer review process after completion of the Technical Report in August of this year, and for the State Water Board to consider potential changes to the 2006 Bay-Delta Plan by June of 2012. The Division requests that peer reviewers provide comments within 60 days of receipt of the peer review package.

Areas of expertise for peer reviewers are identified by Division staff below:

1. Aquatic Ecology and Fishery Science–salmonids (Chinook salmon and Central Valley steelhead) and other riverine/migratory fish and aquatic resources, aquatic biology and ecology, flow requirements, instream flow evaluations, dam/reservoir management for fisheries, and resource/fisheries management.

2. Agricultural Science–crop salt tolerance, water quality, salt loading and concentrations, irrigation practices, and agronomy.

3. Hydrology, Hydrodynamics, and Water Supply–unimpaired and actual hydrology of the San Joaquin River watershed, evaluation of water supply and flow analyses based on post-processing of CALSIM II water resources system simulation modeling output, dynamics of water storage, diversion, and return flows in the San Joaquin Valley.

The following attachments are enclosed in this request:

- Attachment 1: Plain English Summary of the Technical Report and Proposed Objectives and Program of Implementation

- Attachment 2: Listing of Scientific Conclusions or Assumptions Subject to Review

- Attachment 3: List of Participants Involved in Development of the Technical Report and Proposed Objectives and Program of Implementation

- Attachment 4: Chronology of Significant Events Leading to Development of the Technical Report and Proposed Objectives and Program of Implementation

- Attachment 5: Technical Report

- Attachment 6: Dr. Glenn J. Hoffman's (2010) Study Report titled "Crop Salt Tolerance in the Southern Sacramento-San Joaquin River Delta"

Other documents that should be considered by peer reviewers are available on the State Water Board's website at the following locations:

1. Key References used in development of the Technical Report: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/sjrf_spprtinfo.shtml

2. Draft "Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives" (Draft Technical Report), dated October 29, 2010, released for public comment: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/docs/techrpt102910.pdf

3. Notice of Availability of the Draft Technical Report for public comment: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/docs/notice_snjr_techrpt102910.pdf

4. Written public comments received on the Draft Technical Report: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/comments120610.shtml

5. Written public comments received on the draft San Joaquin River flow and southern Delta water quality objectives and program of implementation: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/index.shtml

6. 2006 Bay-Delta Plan: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/wq_control_plans/2006wqcp/docs/2006_plan_final.pdf

7. Appendix 1 to 2006 Bay-Delta Plan, the Plan Amendment Report: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/wq_control_plans/2006wqcp/docs/2006_app1_final.pdf.

If you have any questions regarding this request, please contact me at (916) 445-5987, or via e-mail at kkyler@waterboards.ca.gov.

Attachments

cc: Les Grober
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Erin Mahaney
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Office of Chief Counsel

Attachment 1: Plain English Summary of the Technical Report and Proposed Objectives and Program of Implementation

INTRODUCTION

The State Water Resources Control Board (State Water Board) is in the process of reviewing and potentially modifying the San Joaquin River flow objectives for the protection of fish and wildlife beneficial uses and water quality objectives for the protection of southern Delta agricultural beneficial uses and the program of implementation for those objectives included in the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (2006 Bay-Delta Plan). In support of that review, the State Water Board has developed a report titled "Technical Report on the Scientific Basis for Alternative San Joaquin River Flow Objectives for the Protection of Fish and Wildlife Beneficial Uses and Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses and the Program of Implementation for Those Objectives" (Technical Report).

BACKGROUND

The State Water Board developed the 2006 Bay-Delta Plan and is considering amendments to that plan pursuant to the provisions of the Porter-Cologne Water Quality Control Act (Porter-Cologne) and the federal Clean Water Act. Fundamentally, a water quality control plan consists of three parts: 1) establishment, for the waters within a specified area, of the beneficial uses to be protected; 2) establishment of water quality objectives; and 3) a program of implementation (Wat. Code, § 13050(j)). Together, the beneficial uses and the water quality objectives established to reasonably protect the beneficial uses are called water quality standards, under the terminology of the federal Clean Water Act. Components of the Bay-Delta Plan when implemented also: 1) carry out provisions of the reasonable use doctrine (Cal. Const. Art. X, § 2; Wat. Code, §§ 100, 275, and 1050); 2) protect public trust resources (See National Audubon Society v. Superior Court (1983) 33 Cal.3d 419, 189 Cal.Rptr. 346); and 3) carry out statutory principles pertaining to water rights (Wat. Code, §§ 183, 1243, 1243.5, 1251, 1253, and 1256-1258). As such, the 2006 Bay-Delta Plan addresses the interrelated fields of water quality and water supply and plans for their coordination.

The current San Joaquin River flow objectives for the protection of fish and wildlife beneficial uses are included in Table 3 on page 15 of the 2006 Bay-Delta Plan, and the program of implementation for these objectives starts on page 23. Water quality objectives for the protection of agricultural beneficial uses are currently included in Table 2 on page 13 of the 2006 Bay-Delta Plan, and the program of implementation for these objectives starts on page 27.

Technical Report

Draft changes to the San Joaquin River flow and southern Delta water quality objectives and program of implementation are provided in the Technical Report. Draft changes include general principles that will be addressed in the draft objectives and program of implementation. The exact language of the draft changes to the objectives and program of implementation will be determined based on additional review and public comment. To develop the draft objectives and program of implementation, State Water Board staff reviewed existing scientific information concerning flow needs for the protection of fish and wildlife beneficial uses in the San Joaquin River basin, and salinity and other needs for the protection of southern Delta agricultural beneficial uses. This information is documented in the Technical Report along with information about tools that will be used to develop and evaluate alternatives for those objectives.

Draft Changes to the 2006 Bay-Delta Plan

A plain English summary of the draft objectives and programs of implementation along with a summary of the rationale for the objectives and implementation is provided below. The Technical Report only contains the scientific basis and technical information described above. It does not include all of the information that will be needed for the State Water Board to consider draft changes to the 2006 Bay-Delta Plan, including necessary environmental documentation and other information required pursuant to the Porter-Cologne Act.

San Joaquin River Flows for the Protection of Fish and Wildlife Beneficial Uses

The State Water Board focused its review of San Joaquin River flows on the needs of Central Valley fall-run Chinook salmon and Central Valley steelhead in the San Joaquin River basin. Focus was primarily on the needs of fall-run Chinook salmon, due to the lack of scientific information available regarding flow needs for Central Valley steelhead. State Water Board staff determined that higher and more variable inflows from the three salmon bearing tributaries (Stanislaus, Tuolumne, Merced Rivers) to the mainstem San Joaquin River (measured at Vernalis) and to the Delta, during the spring period (February through June), are needed to reasonably protect fish and wildlife beneficial uses. Staff also determined that while there are many other factors that contribute to impairments to fish and wildlife beneficial uses in the San Joaquin River basin, flows remain a critical component in the protection of these beneficial uses. Staff further determined that estimates of flows needed to protect fish and wildlife beneficial uses are imprecise. This is primarily due to the various complicating factors affecting survival and abundance of Chinook salmon, steelhead, and other San Joaquin River basin fish and wildlife. Nevertheless, the weight of the scientific evidence indicates that increased and more variable flows are needed to protect fish and wildlife beneficial uses. Given the dynamic and variable environment, which San Joaquin River basin fish and wildlife are adapted to and the imperfect human understanding of these factors, State Water Board staff also determined that developing precise flow objectives that will provide absolute certainty with regard to protection of fish and wildlife beneficial uses is likely not possible. Accordingly, State Water Board staff determined that any flow objective needs to incorporate appropriate adaptive management in order to respond to changing circumstances and improved knowledge.

State Water Board staff also pointed out that given the extremely flattened hydrograph of San Joaquin River flows and the various competing demands for water on the San Joaquin River, reasonable protection of fish and wildlife beneficial uses will need to entail consideration of competing beneficial uses of water, which include: municipal and industrial uses, agricultural uses, and other environmental uses.

Based on the above considerations, State Water Board staff developed draft changes to the San Joaquin River flow objectives and the program of implementation for those objectives. The draft changes to the objectives involve changing the existing numeric objectives during the February through June time frame to the following narrative objective:

> *"Maintain flow conditions from the San Joaquin River Watershed to the Delta at Vernalis, together with other reasonably controllable measures in the San Joaquin River Watershed sufficient to support and maintain the natural production of viable native San Joaquin River watershed fish populations migrating through the Delta. Specifically, flow conditions shall be maintained, together with other reasonably controllable measures in the San Joaquin River watershed, sufficient to support a doubling of natural production of Chinook salmon from the average production of 1967-1991, consistent with the provisions of State and federal law. Flow conditions that reasonably contribute toward maintaining viable native migratory San Joaquin River fish populations include, but may not be limited to, flows that mimic the hydrographic conditions to which native fish species are adapted, including the relative magnitude, duration, timing, and spatial extent of those flows. Indicators of species viability include abundance, spatial extent or distribution, genetic and life history diversity, migratory pathways, and productivity."*

The draft changes to the objectives also involve adding additional compliance locations at the confluences of the three salmon bearing tributaries to the mainstem San Joaquin River.

The draft program of implementation for the flow objectives specifies that the narrative San Joaquin River flow objective is to be implemented through water right actions, water quality actions, and actions by other agencies in an adaptive management framework informed by required monitoring, special studies, and reporting. The purpose of the implementation framework is to achieve the narrative San Joaquin River flow objective by: 1) providing less altered flow conditions that more closely mimic the shape of the unimpaired[1] hydrograph, including: increased flow of a more natural spatial and temporal pattern; 2) providing for adaptive management, in order to respond to changing information on flow needs and to minimize water supply costs; and 3) allowing for and encouraging coordination and integration of existing and future regulatory processes. Specifically, the draft program of implementation provides for maintaining a certain percent of unimpaired flow (20 to 60 percent), during February through June, from each of the three salmon bearing tributaries to the mainstem San Joaquin River at Vernalis. A minimum flow that must be maintained at Vernalis during this period, along with a maximum flow at which point additional flows would not be required, will also be specified. The State Water Board will make a determination, concerning the required percentage of unimpaired flow, based on the consideration of environmental impacts of alternative percentages (20, 40, and 60 percent), economic information, and information concerning other competing beneficial uses of water.

[1] In this case, unimpaired flow is a modeled flow generally based on historical gage data with factors applied to primarily remove the effects of dams and diversions within the watersheds. The modeled unimpaired flow does not attempt to remove changes that have occurred such as channelization and levees, loss of floodplain and wetlands, deforestation, and urbanization.

Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses

In order to inform the development and evaluation of alternative water quality objectives for the protection of southern Delta agricultural beneficial uses included in the 2006 Bay-Delta Plan, a contract was established with an independent expert to review the current scientific literature regarding crop salt tolerance and to assess current conditions in the southern Delta. That work resulted in a report by Dr. Glenn Hoffman titled "Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta" (Hoffman, 2010). Hoffman's (2010) major conclusions are discussed in the Technical Report. In addition to reviewing current crop salt tolerance information, State Water Board staff evaluated the effects of salt loading from wastewater treatment plants and found the effects of such discharges on agricultural water supplies in the southern Delta to be minimal.

State Water Board staff developed draft changes to the water quality objectives for the protection of southern Delta agriculture and the program of implementation for those objectives included in the 2006 Bay-Delta Plan. Based on the information and analysis contained in Hoffman's (2010) report, it was determined that higher salinity objectives for the interior southern Delta could still be protective of agricultural beneficial uses. These higher objectives are also more reflective of actual salinity conditions that occur in the southern Delta. The draft objectives also include a new narrative water level and circulation objective intended to minimize low-flow null zones associated with SWP and CVP pumping operations in the southern Delta. These low-flow null zones can contribute to elevated salinity concentrations. The draft changes to the program of implementation also require special studies and the development of a long-term monitoring plan, to better characterize salinity conditions in the southern Delta waterways; and the development of a comprehensive operations plan for compliance with the narrative water level and circulation objective. In addition, the draft program of implementation will provide regulatory flexibility that reasonably accounts for the challenges of meeting objectives that are protective of local beneficial uses.

Attachment 2: Listing of Scientific Conclusions or Assumptions Subject to Review

The statutory mandate for external scientific peer review (Health and Safety Code, § 57004) states that the reviewer's responsibility is to determine whether the scientific portion of any proposed rule is based upon sound scientific knowledge, methods, and practices.

We request that you make this determination for each of the following issues that constitute the scientific portion of any proposed regulatory action. An explanatory statement is provided for each issue to focus the review. A background summary has been provided for each topic listed below.

The State Water Board requests that the peer reviewers review the "Technical Report on the Scientific Basis for Alternative San Joaquin River Flow Objectives for the Protection of Fish and Wildlife Beneficial Uses and Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses and the Program of Implementation for Those Objectives" (Technical Report), which includes the draft regulation and the scientific information on which that regulation was based and will be evaluated, including the following information:

In the event peer reviewers have a question on a topic or issue in the Technical Report, which requires further clarification from the State Water Board, they are asked to submit their request for clarification to Kari Kyler via email at kkyler@waterboards.ca.gov. All requests for clarification will be responded to via email and will be made a part of the Technical Report.

Issues pertaining to San Joaquin River Flows for the Protection of Fish and Wildlife Beneficial Uses

1. **Adequacy of the Technical Report's hydrologic analysis of the San Joaquin River basin comparing unimpaired flow with actual observed flows in representing changes that have occurred to the hydrograph of the San Joaquin River basin in order to provide background and support for the remaining chapters of the Technical Report.**

State Water Board staff finds that the comparison of actual observed flows to unimpaired flows included in the Technical Report adequately portrays the significant changes that have occurred to the flow regime of the San Joaquin River basin and provides the necessary background for subsequent sections in the Technical Report.

To describe important flow characteristics such as: annual, inter-annual, and seasonal components of the unimpaired annual hydrograph; and how they have been altered within the project area, the Technical Report compares unimpaired flow to actual observed flow. Unimpaired flow is roughly the flow that would occur in the existing channels if all water remained in a water body instead of being stored or diverted; whereas actual flow, in the context applied, is the flow that is actually observed within the river.

The Technical Report focuses on the flow characteristics of the San Joaquin River at Vernalis, and includes:

- The major San Joaquin River tributaries (Stanislaus, Tuolumne, and Merced Rivers)
- The San Joaquin River upstream of the Merced River Confluence
- The non-major San Joaquin River tributaries (Fresno and Chowchilla Rivers)
- The Tulare Basin

Specifically, the magnitude, duration, timing, and frequency of flows, in the San Joaquin River basin were evaluated to assess the types of changes to the flow regime that have occurred. This information is provided as background and supporting information for the subsequent chapters in the Technical Report. The hydrologic analysis indicates that water development in the basin has resulted in: reduced annual flows; fewer peak flows; reduced and shifted spring and early summer flows; reduced frequency of peak flows from winter rainfall events; shifted fall and winter flows; and a general decline in hydrologic variability over multiple spatial and temporal scales.

2. Determination that changes in the flow regime of the San Joaquin River basin are impairing fish and wildlife beneficial uses.

State Water Board staff concludes that the scientific information presented in the Technical Report indicates that reductions in flows and other changes in the flow regime of the San Joaquin River basin resulting from water development over the past several decades are impairing fish and wildlife beneficial uses.

Water development in the San Joaquin River basin has resulted in large reductions in flows and other changes to the flow regime that adversely affect fish and wildlife beneficial uses. Currently, there is relatively little unregulated runoff from the San Joaquin River basin with dams regulating at least 90 percent of the inflow. Dams and diversions in the basin cause a significant overall reduction of flows compared to pre-development conditions, with a median reduction in annual flows of 54 percent and median reduction of critical spring flows between 81 and 86 percent during April and May, respectively. Since intensive water development started in the San Joaquin River basin in the 1940s and prior, Chinook salmon and Central Valley steelhead populations in the San Joaquin River basin have declined dramatically. The San Joaquin River basin once supported large spring-run and fall-run Chinook salmon populations. At present, the basin only supports a diminishing fall-run population with decreasing population resiliency. The Central Valley steelhead population has also exhibited significant declines. Scientific evidence indicates that in order to protect fish and wildlife beneficial uses in the San Joaquin River basin, including increasing the populations of fall-run Chinook salmon and Central Valley steelhead, changes to the altered hydrology of the San Joaquin River system are needed to create a flow regime that more closely mimics the shape of the unimpaired hydrograph, in terms of the magnitude, frequency, duration, timing, and rate of change of the flows.

3. **Appropriateness of the approach used to develop San Joaquin River flow objectives for the reasonable protection of fish and wildlife beneficial uses and the associated program of implementation.**

Given the emphasis of the 2006 Bay-Delta Plan on beneficial uses in the Bay-Delta and the sensitivity of species migrating to and from the Bay-Delta via the San Joaquin River, State Water Board staff focused its review of San Joaquin River flows on the needs of Central Valley fall-run Chinook salmon and Central Valley steelhead, and most particularly on the needs of Central Valley fall-run Chinook salmon due to the lack of scientific information available regarding flow needs for Central Valley steelhead. In addition, State Water Board staff considered the importance of the flow regime in supporting ecosystem processes needed to protect fish and wildlife beneficial uses.

In order to develop San Joaquin River flow objective alternatives, existing scientific literature relating to San Joaquin River inflows and protection of fish and wildlife beneficial uses was evaluated. Specifically, the following information was evaluated and is summarized in the Technical Report: life-history information and population trends of San Joaquin River basin fall-run Chinook salmon and Central Valley steelhead; fall-run Chinook salmon flow needs, including the functions supported by those flows and the relationship between flows and fall-run Chinook salmon survival and abundance; and the importance of the flow regime in supporting ecosystem processes for fall-run Chinook salmon, Central Valley steelhead, and other native species. The information was then used to develop a range of potential alternative San Joaquin River flow objectives to protect fish and wildlife beneficial uses.

4. **Determination that more flow of a more natural spatial and temporal pattern is needed from the three salmon bearing tributaries to the San Joaquin River during the February through June time frame to protect San Joaquin River fish and wildlife beneficial uses.**

State Water Board staff concludes that more flow of a more natural pattern is needed during the February through June time frame from the San Joaquin River watershed to Vernalis to achieve the narrative San Joaquin River flow objective. Specifically, more flow is needed from the existing salmon and steelhead bearing tributaries in the San Joaquin River watershed down to Vernalis in order to provide for connectivity with the Delta and more closely mimic the flow conditions to which native migratory fish are adapted. Salmon bearing tributaries to the San Joaquin River currently include the Stanislaus, Tuolumne, and Merced Rivers.

The Technical Report presents scientific information which indicates that a higher and more natural flow regime on the San Joaquin River during the spring period (February through June) is needed to meet the narrative San Joaquin River flow objective. State Water Board staff found that the primary limiting factor for San Joaquin River basin fall-run Chinook salmon survival and subsequent abundance is reduced flows during the spring when fry and smolts are completing the rearing phase of their life cycle and migrating from the San Joaquin River basin to the Delta. As such, while San Joaquin River flows outside of the February through June time frame are also important, the focus of the State Water Board's current San Joaquin River flow planning efforts are on the critical spring period of February through June. In addition, State Water Board staff determined that it is ecologically important for adequate flows to be maintained in all three salmon bearing tributaries to the San Joaquin River, in order to support the viability of fall-run

Chinook salmon and other native San Joaquin River fish populations. Accordingly, the proposed San Joaquin River flow objective and program of implementation call for maintaining flows in all three salmon bearing tributaries to the San Joaquin River.

State Water Board staff further concludes in the Technical Report that, in general, more natural spatial and temporal patterns in flow conditions provide the types of flows needed to support the biological and ecosystem processes needed to support native San Joaquin River fish species migrating through the Delta. Under unaltered, pre-development conditions in the San Joaquin River basin, flows on the three salmon bearing tributaries and the mainstem San Joaquin River generally increased in response to snow-melt and precipitation during the spring period. Chinook salmon migration patterns have adapted to these natural variations in flow conditions. Specifically, higher flows of various magnitudes support a variety of functions including: 1) maintenance and expansion of channel habitat, 2) supporting the food web by increasing food and nutrient availability, 3) transporting sediment (creating turbid instream conditions), organic materials, food, and other nutrients, and 4) improving water quality conditions by reducing temperatures, increasing dissolved oxygen levels, and reducing contaminant concentrations.

5. **Appropriateness of using a percentage of unimpaired flow, ranging from 20 to 60 percent, during the February through June time frame, from the Stanislaus, Tuolumne, and Merced Rivers as the proposed method for implementing the narrative San Joaquin River flow objective.**

State Water Board staff find that requiring a percent of unimpaired flow, ranging from 20 to 60 percent, during the February through June time frame, from the Stanislaus, Tuolumne, and Merced Rivers is an appropriate method for implementing the narrative San Joaquin River flow objective in a way that reasonably protects fish and wildlife beneficial uses, given the other factors that the State Water Board must consider when determining a reasonable level of protection for beneficial uses.

State Water Board staff conclude in the Technical Report that estimates of flow needs to meet the narrative San Joaquin River flow objective are imprecise given the various complicating factors affecting survival and abundance of Chinook salmon, steelhead, and other native San Joaquin River basin fish species. Nevertheless, the weight of scientific evidence indicates that increased and more naturally variable flows are needed to protect fish and wildlife beneficial uses. To achieve more flow and more natural flow patterns, State Water Board staff has determined that a percent of unimpaired flow ranging from 20 to 60 percent should be provided in the February through June time frame from the Stanislaus, Tuolumne, and Merced Rivers in addition to San Joaquin River Restoration flows and runoff from other low lying areas to a yet to be determined maximum of flow at Vernalis, unless otherwise approved by the State Water Board as described in the draft program of implementation. In addition, State Water Board staff has determined that base flows should be provided at Vernalis at all times during the February through June time frame, the amount of which will be determined through subsequent analysis. In recognition of the limits of the unimpaired flow approach, the draft program of implementation includes appropriate measures for implementation and adaptive management.

6. Appropriateness of proposed method for evaluating potential water supply impacts associated with flow objective alternatives on the San Joaquin River at Vernalis, and the Stanislaus, Tuolumne, and Merced Rivers.

State Water Board staff, in the Technical Report, present a method of post-processing model output from the CALSIM II San Joaquin River Water Quality Module (CALSIM II) as a way of estimating water supply impacts (i.e., surface water diversion reductions) incurred to meet the flow objective alternatives on the San Joaquin River at Vernalis, and the Stanislaus, Tuolumne, and Merced Rivers.

In the Technical Report, State Water Board staff use CALSIM II model output to provide an estimate of flows on the San Joaquin River at Vernalis and the Stanislaus, Tuolumne, and Merced Rivers over a range of hydrologic conditions, assuming current levels of water resources infrastructure development. This output is then compared against estimates of flow needed to satisfy a particular set of San Joaquin, Stanislaus, Tuolumne, and Merced River flow objective alternatives, and to calculate the amount of additional water needed to attain these objectives. The additional water needed is then compared against CALSIM II estimates of total diversions from the three salmon bearing tributaries to the mainstem San Joaquin River (Stanislaus, Tuolumne, and Merced Rivers) and the portion of the San Joaquin River between Vernalis and its confluence with the Merced River. The water supply impact is then calculated as the amount of reduction in these diversions that is needed to achieve potential objectives.

Issues Pertaining to Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses

7. Sufficiency of the statistical approach used by State Water Board staff in the Technical Report to characterize the degradation of salinity conditions between Vernalis and the interior southern Delta.

State Water Board staff concludes in the Technical Report that the salinity correlation analysis provides a reasonable general characterization of the salinity degradation between Vernalis and the southern Delta.

An estimate of salinity degradation between Vernalis and interior southern Delta locations is needed to compare against the amount of assimilative capacity that is being provided by the difference in the objectives established at these locations. As used here, the term assimilative capacity refers to the amount of increase in a constituent concentration that can occur in surface water before the concentration exceeds an objective (i.e. exceeds the level that is protective of beneficial uses) at some downstream location. Understanding the relationship between salinity at the upstream San Joaquin River at Vernalis station and the three interior southern Delta salinity stations will also help understand how conditions in the southern Delta will be affected by changes in salinity at Vernalis resulting from the various actions described in the San Joaquin River flow and southern Delta water quality objective implementation plans. For the purpose of these evaluations, State Water Board staff believes that this type of analysis only needs to provide a conservative estimate and does not require the dynamic and higher resolution modeling provided by the California Department of Water Resources' Delta Simulation Model (DSM2) or other hydrodynamic and water quality models of the south Delta.

8. Sufficiency of the mass balance analysis presented by State Water Board staff in the Technical Report for evaluating the relative effects of National Pollutant Discharge Elimination System (NPDES) permitted point sources discharging in the southern Delta.

State Water Board staff's mass balance analysis contained in the Technical Report indicates that NPDES point source discharges contribute limited salt loading in the southern Delta as compared to the loading of salt from the San Joaquin River at Vernalis.

The Technical Report includes a simple mass-balance analysis to evaluate the existing levels of salt loading from NPDES point sources in the southern Delta relative to the salt load from the San Joaquin River at Vernalis. The analysis demonstrates that the salt load from point sources in this part of the southern Delta is a small percentage of the salt load entering from upstream. As beneficial uses are affected more by longer term salinity averages, the analysis is based on monthly averages to understand the relative importance of major contributing factors, and does not account for dynamic mechanisms that affect short-term and localized fluctuations in salinity concentrations. Such short-term and localized effects will be assessed further by the monitoring and reporting studies that will be required in the program of implementation for the southern Delta water quality objectives. The mass balance analysis will inform the policy decision regarding the level of responsibility of NPDES discharges to address salinity loading in the southern Delta.

9. Determination by State Water Board staff that the methodology and conclusions in the January 2010 report by Dr. Glenn Hoffman, regarding acceptable levels of salinity in irrigation water, are appropriate for reasonable protection of agricultural beneficial uses in the southern Delta.

State Water Board staff relied primarily on Dr. Glenn Hoffman's report titled "Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta" (Hoffman, 2010) in forming the conclusion that irrigation water salinity levels in the range of 0.9 dS/m to 1.1 dS/m would be reasonably protective of agricultural beneficial uses in the southern Delta.

Based on the results of Hoffman's (2010) steady-state soil water salinity analysis and comparison to published crop salt tolerance information, State Water Board staff concluded that salinity levels in irrigation water in the range of 0.9 dS/m to 1.1 dS/m would be reasonably protective of agricultural beneficial uses, assuming information specific to the southern Delta, including crop type, climate, irrigation practices, leaching, and soil type. State Water Board staff proposes to use this steady-state methodology, assumptions regarding southern Delta-specific conditions, and overall conclusions in the Hoffman (2010) report as the basis for establishing and evaluating alternative salinity objectives for the southern Delta.

10. Other Issues

Additionally, reviewers are not limited to addressing only the specific issues presented above, and are asked to contemplate the following "Big Picture" questions:

- In reading the Technical Report and draft objectives and program of implementation, are there any additional scientific issues that should be a part of the scientific portion of the proposed rule that are not described above?

- Taken as a whole, is the scientific portion of the draft objectives and program of implementation based upon sound scientific knowledge, methods, and practices?

Reviewers should note that some proposed actions may rely significantly on professional judgment in instances where scientific data and our understanding of the underlying processes are not as extensive as may be ideal. Nonetheless, the evaluation of the scientific data and use of professional judgment are appropriate in the context of current scientific knowledge regarding such actions. In these situations, the proposed course of action is favored over no action.

The preceding guidance will ensure that reviewers have an opportunity to comment on all aspects of the scientific basis of the proposed State Water Board action. At the same time, reviewers also should recognize that the State Water Board has a legal obligation to consider and respond to all feedback on the scientific portions of the proposed rules. Because of this obligation, reviewers are encouraged to focus feedback on the scientific issues that are relevant to the central regulatory elements being proposed.

Attachment 3: List of Participants Involved in Development of the Technical Report and Proposed Objectives and Program of Implementation

State Water Board staff prepared the Technical Report using regulatory guidance, available scientific literature, and the examples of other regulatory programs.
Dr. Glenn Hoffman was funded through contracts with the Department of Water Resources and the San Joaquin River Group Authority, but worked independently with assistance from State Water Board staff in the development of the report titled "Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta" (Hoffman, 2010), which is a large part of the scientific basis for the alternate southern Delta salinity objectives.

In addition, Russ Brown, of ICF International, is assisting the State Water Board with the development of a Substitute Environmental Document and supporting documents, which include the Technical Report. ICF International is under contract with the State Water Board.

State Water Board Staff:

Erin Mahaney
Les Grober
Diane Riddle
Mark Gowdy
Lucas Sharkey
Kyle Ochenduszko
Kari Kyler
Chris Carr
Anne Snider
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Collaborating Non-Staff Members:

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Attachment 4: Chronology of Significant Events Leading to Development of the Technical Report and Proposed Objectives and Program of Implementation

- **1958 to 1970—State Water Board Adopts Decisions Approving Permits for the Central Valley Project (CVP):** During a twelve year period, the State Water Board adopted six decisions (Decisions 893, 990, 1020, 1250, 1308, and 1356) approving permits for various components of the federal CVP operated by United States Bureau of Reclamation (USBR). Decision 990 approved water rights for the CVP. The State Water Board did not attach specific water quality standards as terms and conditions of the CVP permits; however, it did reserve jurisdiction to revisit water quality requirements (including salinity requirements) in the future.
- **1967—State Water Board Adopts Decision 1275 (D-1275):** In D-1275, the State Water Board approved permits for the Department of Water Resources' (DWR) State Water Project (SWP) and conditioned the permits on meeting water quality criteria at several Delta locations. This adoption of agricultural salinity standards began the development of water quality standards for the Bay-Delta Estuary. The State Water Board also included permit conditions reserving the State Water Board's jurisdiction to address salinity control in the Delta.
- **1973—State Water Board Adopts Decision 1422 (D-1422):** D-1422 approved the permits for USBR's New Melones Reservoir on the Stanislaus River and conditioned the permits on meeting total dissolved solids of 500 parts per million (~833 mmhos/cm electrical conductivity [EC]) on the San Joaquin River at Vernalis.
- **1976—University of California Conducts Study on Effects of Salinity on Delta Crops:** The University of California calculated the maximum salinity of applied water which sustains 100 percent yields of two important salt sensitive crops grown in the southern Delta (beans during the summer irrigation season and alfalfa during the winter irrigation season), in conditions typical of the southern Delta.
- **1978—State Water Board Adopts 1978 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1978 Bay-Delta Plan) and Decision 1485 (D-1485):** Based on the conclusions of the University of California crop study, the State Water Board, in the 1978 Bay-Delta Plan, established the salinity objectives in effect today. Specifically, it found that to protect southern Delta agriculture it was necessary to maintain a 30-day running average salinity objective of 0.7 mmhos/cm EC from April through August and 1.0 mmhos/cm EC from September through March at four locations in the southern Delta: 1) the San Joaquin River at Vernalis, 2) San Joaquin River at Brandt Bridge, 3) Old River near Middle River, and 4) Old River at Tracy Road. The State Water Board believed that the most practical solution for long-term protection of southern Delta agriculture was the construction of physical facilities to provide adequate circulation and substitute supplies, but negotiations concerning these facilities were underway at the time D-1485 was under consideration. Therefore, the State Water Board did not allocate responsibility for the 1978 Bay-Delta Plan southern Delta EC objectives in D-1485. The 1978 Bay-Delta Plan and D-1485 state that if contracts to ensure the water supplies and facilities mentioned above are not executed by January 1, 1980, the State Water Board will take appropriate enforcement actions to prevent encroachment on riparian rights in the southern Delta. Contracts were not negotiated, but South Delta Water Association (SDWA) asked the State Water Board to delay taking action.

- **1991—State Water Board Adopts 1991 Water Quality Control Plan for Salinity for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1991 Bay-Delta Plan):** The State Water Board did not change the southern Delta EC objectives in the 1991 Bay-Delta Plan from the objectives in the 1978 Bay-Delta Plan. However, because of on-going negotiations among DWR, USBR, and SDWA, the State Water Board established a staged implementation plan for the objectives with two interim stages and a final stage. The final stage, to be implemented no later than 1996, required implementation of a 30-day running average EC at all four southern Delta locations (Vernalis, Brandt Bridge, Old River near Middle River, and Old River at Tracy Road) of 0.7 mmhos/cm between April and August and 1.0 mmhos/cm between September and March for all year-types. The 1991 Bay-Delta Plan also stated that if a three party contract has been implemented among DWR, USBR, and SDWA, that contract will be reviewed prior to implementation of the southern Delta EC objectives and, after also considering the needs of other beneficial uses, revisions will be made to the objectives and compliance/monitoring locations noted, as appropriate.

- **1995—State Water Board Adopts the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 Bay-Delta Plan):** The State Water Board first established the flow objectives for the San Joaquin River at Vernalis in the 1995 Bay-Delta Plan to protect fish and wildlife beneficial uses. The State Water Board set different numeric objectives based on water year type for three time periods: February through June, excluding April 15 through May 15 (spring flows); April 15 through May 15 (pulse flows); and October (fall flows). The spring flows are intended to provide minimum net downstream freshwater flows in the San Joaquin River to address habitat concerns from reduced flows and water quality degradation. The pulse flows were principally developed to aid in cueing Chinook salmon smolt outmigration from the San Joaquin River. The fall flows were developed to provide attraction flows for adult salmon returning to the watershed to spawn. The spring flow and pulse flow objectives include two levels for each time period. The trigger for the higher flow is based, in part, on hydrological conditions in the Sacramento River watershed that may be very different than those in the San Joaquin River watershed.

  The State Water Board did not change the southern Delta EC objectives in the 1995 Bay-Delta Plan from the objectives in the 1991 Bay-Delta Plan except that the effective date of the objectives at the Old River sites was extended from January 1, 1996 to December 31, 1997. The 1995 Bay-Delta Plan includes the same condition as the 1991 Bay-Delta Plan regarding review of the objectives upon execution of a three-party agreement.

- **1995 to 1998—State Water Board Adopts Water Rights Orders to provide for Interim Implement of the 1995 Bay-Delta Plan (Orders 95-6, 98-9):** The State Water Board temporarily amended DWR's and USBR's water rights for the SWP and the CVP, respectively, to be consistent with the 1995 Bay-Delta Plan. The orders allowed DWR and USBR to operate the SWP and CVP in accordance with the 1995 Bay-Delta Plan while the State Water Board prepared a long-term water right decision to implement the plan. Among other requirements, the orders required USBR to release conserved water from New Melones Reservoir to comply with the 1995 Bay-Delta Plan Vernalis EC objectives (0.7 mmhos/cm during April through August and 1.0 mmhos/cm during September through March).

- **1998 to 1999—State Water Board Conducts Hearings to Implement 1995 Bay-Delta Plan:** The State Water Board held over 80 days of hearings on how to best implement the objectives in the 1995 Bay-Delta Plan. The State Water Board received evidence that permanent operable barriers to be constructed in the southern Delta by 2005 would significantly improve southern Delta salinity. The State Water Board also received requests to conduct a staged implementation of the San Joaquin River pulse flow objectives with the first stage involving an experiment referred to as the Vernalis Adaptive Management Program (VAMP) in lieu of implementing the pulse flow objectives called for in the 1995 Bay-Delta Plan for a 12-year period.

- **December 1999 and March 2000—State Water Board Adopts Decision 1641 (D-1641) and Revises it in Response to Petitions for Reconsideration:** The State Water Board assigned sole responsibility to USBR for meeting the Vernalis EC objectives and DWR and USBR for meeting the EC objectives at Brandt Bridge, Old River near Middle River, and Old River at Tracy Road. D-1641 immediately implemented the Vernalis objectives and implemented a year round salinity objective of 1.0 mmhos/cm at the interior southern Delta stations until April of 2005. After April of 2005, D-1641 requires implementation of a salinity objective of 0.7 mmhos/cm during April through August unless permanent barriers or equivalent measures are completed and a plan to protect agriculture is approved, in which case the required salinity objective is 1.0 mmhos/cm.

  The State Water Board also implemented the spring flow objectives and fall flow objectives in the 1995 Bay-Delta Plan by requiring USBR to meet the objectives. In order to obtain additional scientific information on which to base the objectives, in D-1641 the State Water Board also approved conducting the VAMP experiment proposed in the San Joaquin River Agreement (SJRA), in lieu of meeting the pulse flow objectives included in the 1995 Bay-Delta Plan, until 2012. The SJRA calls for willing sellers of water on the Stanislaus, Tuolumne, and Merced Rivers to provide water to meet VAMP flow targets. The VAMP flow targets are lower than the 1995 Bay-Delta Plan pulse flow objectives. The determination regarding responsibility for meeting the San Joaquin River flow objectives was made primarily based on the SJRA, rather than consideration of factors related to protection of fish and wildlife beneficial uses.

- **2006—State Water Board Adopts the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (2006 Bay-Delta Plan):** In the 2006 Bay-Delta Plan, the State Water Board made minimal changes to the San Joaquin River flow and southern Delta salinity objectives and program of implementation included in the 1995 Bay-Delta Plan due to concerns about the adequacy of scientific information available on which to base substantive changes to the Plan. However, the 2006 Bay-Delta Plan identified a number of emerging issues associated with ecosystem health and other concerns about beneficial uses in the Bay-Delta, including San Joaquin River flow and southern Delta salinity objectives, and committed to begin a process to evaluate and prioritize activities to address them.

- **February 2009—State Water Board Releases "Notice of Preparation and of Scoping Meeting for Environmental Documentation for the Update and Implementation of the Bay Delta Plan: Southern Delta Salinity and San Joaquin River Flows":** The scoping meeting was held on March 30, 2009. In addition, the State Water Board issued a notice of public staff workshop, which was subsequently held on April 22, 2009, to receive further information and conduct discussions regarding southern Delta salinity and San Joaquin River flow objectives.

- **2009—State Water Board Periodic Review 2006 Bay-Delta Plan:** The State Water Board conducted a review of the 2006 Bay-Delta Plan, as required by the California Water Code (sections 13170 and 13240) and the federal Clean Water Act (section 303(c)(1)), and prepared a Staff Report on Periodic Review of the 2006 Bay-Delta Plan (Report). The Report focused on key issues concerning Bay-Delta ecology and water quality, including those that were identified in the August 2008 "Request for Written Input on Factual Issues Regarding the Bay-Delta." The Report reiterates the State Water Board's commitment to review and potentially modify southern Delta salinity and San Joaquin River flow objectives included in the 2006 Bay-Delta Plan, and their implementation through water rights and other measures by 2012.

- **2009 to 2010—Release of Dr. Glenn Hoffman's Report "Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta" (Hoffman, 2010; Study Report):** On August 13, 2009, and November 4, 2009, two public staff workshops were held related to southern Delta salinity, specifically for Dr. Glen Hoffman to present the draft Study Report and discuss responses to written comments and how the comments will be addressed in the final Study Report. The final Study Report was released on January 5, 2010. The final Study Report finds that salinity levels needed for the protection of southern Delta agriculture vary significantly depending on site-specific conditions (crop type, rainfall, season, irrigation practices, leaching, and soil type). Based on the results of steady-state soil water salinity analysis, and comparison to published crop salt tolerance information, Dr. Hoffman's Study Report concludes that higher salinity objectives for the interior southern Delta could still be protective of agricultural beneficial uses.

- **October 2010 to January 2011—Release of the "Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives" (Draft Technical Report), Dated October 29, 2010, for Public Comment and Public Workshop:** The Draft Technical Report was developed to document the scientific basis and tools used for developing and evaluating alternative San Joaquin River flow and southern Delta salinity objectives and a program of implementation to achieve those objectives. The Draft Technical Report was made available for public comment and was the subject of a public workshop on January 6 and 7, 2011 in order to inform any changes that should be made to the report prior to submittal for peer review.

- **August 2011—Submittal of the "Technical Report on the Scientific Basis for Alternative San Joaquin River Flow Objectives for the Protection of Fish and Wildlife Beneficial Uses and Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses and the Program of Implementation for Those Objectives" (Technical Report) for Peer Review:** The State Water Board revised the Technical Report in response to comments received prior to and during the January 6 and 7, 2011 workshop. In addition, the proposed draft changes to the San Joaquin River flow and southern Delta water quality objectives and the program of implementation for those objectives was incorporated into the Technical Report.

San Joaquin River flow objectives for the protection of fish and wildlife beneficial uses and water quality objectives for the protection of southern Delta agricultural beneficial uses and the program of implementation for those objectives are the subject of this review. Both topics are outstanding issues and have been the subject of previous State Water Board actions as described in the above chronology.